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Report on the Fall 2005 Mission

INNOVATIVE TECHNIQUES IN THE PLANNING AND FINANCING OF PUBLIC TRANSPORTATION PROJECTS

This TCRP digest summarizes the mission performed October 20–November 5, 2005, under TCRP Project J-3, "International Transit Studies Program." This digest includes transportation information on the cities and facilities visited. This digest was prepared by staff of the Eno Transportation Foundation and is based on reports filed by the mission participants.

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INTERNATIONAL TRANSIT STUDIES PROGRAM

The International Transit Studies Program (ITSP) is part of the Transit Cooperative Research Program (TCRP). ITSP is managed by the Eno Transportation Foundation under contract to the National Academies. TCRP was authorized by the Intermodal Surface Transportation Efficiency Act of 1991 and reauthorized in 2005 by the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users. It is governed by a memorandum of agreement signed by the National Academies, acting through its Transportation Research Board (TRB); by the Transit Development Corporation, which is the education and research arm of the American Public Transportation Association (APTA); and by the Federal Transit Administration (FTA). TCRP is managed by TRB and funded annually by a grant from FTA.

ITSP is designed to assist in the professional development of transit managers, public officials, planners, and others charged with public transportation responsibilities in the United States. The program accomplishes this objective by providing opportunities for participants to learn from foreign experience while expanding their network of domestic and international contacts for addressing public transport problems and issues.

The program arranges for teams of public transportation professionals to visit exemplary transit operations in other countries. Each study mission focuses on a theme that encompasses issues of concern in public transportation. Cities and transit systems to be visited are selected on the basis of their ability to demonstrate new ideas or unique approaches to handling public transportation challenges reflected in the study mission's theme. Each study team begins with a briefing before departing on an intensive, professionally challenging 2-week mission, after which the team members return home with ideas for possible application in their own communities. Team members are encouraged to share their international experience and findings with peers in the public transportation community throughout the United States. Study mission experience also helps transit managers to better evaluate current and proposed transit improvements and can serve to generate potential public transportation research topics.

TRANSPORTATION RESEARCH BOARD
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Study missions are normally conducted in the spring and fall of each year. Study teams consist of up to 14 individuals, including a senior official designated as the group's spokesperson. Transit properties are contacted directly and requested to nominate candidates for participation. Nominees are screened by a committee of transit officials, and the TCRP Project J-3 Oversight Panel endorses the selection.

Study mission participants are transit management personnel with substantial knowledge and experience in transit activities. Participants must demonstrate potential for advancement to high levels of public transportation responsibilities. Other selection criteria include current responsibilities, career objectives, and the probable professional development value of the mission for the participant and sponsoring employer. Travel expenses for participants are paid through TCRP Project J-3 funding.

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About This Digest

The following digest is an overview of the mission that investigated innovative techniques in the planning and financing of public transportation projects in Spain, Denmark, the People's Republic of China, and Japan. It is based on individual reports provided by the team members (for a roster of the team members, see Appendix A), and it reflects the views of the team members, who are responsible for the facts and accuracy of the data presented. The digest does not necessarily reflect the views of TCRP, TRB, the National Academies, APTA, FTA, or the Eno Transportation Foundation.

INNOVATIVE TECHNIQUES IN THE PLANNING AND FINANCING OF PUBLIC TRANSPORTATION PROJECTS

The theme of this study mission was "Innovative Techniques in Planning and Financing of Public Transportation Projects." Over a 2-week period, the study team met with senior officials and management staffs of public and private sector transit organizations in four major cities in Europe and Asia: Barcelona, Spain; Copenhagen, Denmark (including a brief day trip to Malmö, Sweden); Shanghai, China; and Osaka, Japan (for a list of host organizations, see Appendix B).

Transit officials in the United States increasingly face the challenge of working in an environment where assumptions about government-supported, taxpayer-funded public transportation are changing. Governments are stretched thin and are being forced to make tough budget decisions about competing priorities. Policymakers and taxpayers are inclined to resist tax increases for expanding the transportation infrastructure or supporting ongoing operations. And private companies are getting more involved in the debate, pushing for a role in funding and operating transit systems traditionally run by government entities.

European and Asian public transportation officials have thus far more readily pursued innovative transit planning and financing solutions that involve private companies. The study team sought to discover financing, investment, and operations models produced by such arrangements that could be instructive for transit providers in the United States. The four cities chosen by the J-3 project panel are those where public/private partnerships are working to fund and operate both new and existing projects. While the degree of private involvement varies from city to city, and often from mode to mode within each city, private companies are increasingly becoming partners in planning, funding, and managing transit capital and operations projects.

This digest provides background information about each of the four cities visited by the mission team and the characteristics of their public transportation offerings. Subsequent sections discuss the planning and financing arrangements that support public transportation in the cities.

OVERVIEW OF PUBLIC TRANSPORTATION NETWORKS

Barcelona, Spain

Barcelona is Spain's second largest city and capital of the autonomous Spanish state of Catalonia. It is located in the northeastern part of the country, roughly 100 mi south of the French border, on the Mediterranean seaboard. Barcelona is renowned for its parks and open spaces, modernist architecture, and museums. The city was also the site of the 1992 Summer Olympic Games.

Barcelona occupies a land area of 62 mi^2 and has a population of 1.6 million. The entire Barcelona metropolitan area, or Region Metropolitana de Barcelona (RMB), comprises seven counties with 164 municipalities covering an area of 2,013 mi^2. The RMB's total population is 4.7 million.

Public transportation is an important component of Barcelona's overall transportation system. A wide variety of public transportation services are offered, including buses, heavy rail (metro), light rail (trams), and commuter rail. For the entire metropolitan area, 25% of all daily trips rely on public transportation. Within the city, public transportation accounts for 41% of total daily trips and 64% of all motorized trips. These statistics compare favorably to other major cities in Europe that have similar population densities.

The Barcelona public transportation system is composed of a complex combination of public and private entities, each assigned a specific task in carrying out the mission of the overall system. Overall public transportation in the RMB is coordinated by Autoritat del Transport Metropolità (ATM), an inter-administrations voluntary consortium open to all authorities responsible for collective transport services in the region. The ATM's main duties are to plan the public transport infrastructure and services, to prepare and approve a common fare framework, to establish relations with transport operators, to prepare the proposals for funding agreements with the different public administrations, and to establish communications campaigns to enhance the image of the metropolitan public transport system.

Transports Metropolitans de Barcelona (TMB), a public company composed of Transports de Barcelona S.A. and Ferrocarril Metropolita de Barcelona S.A., provides metro and bus service. The metro system has six lines covering 53 mi of track. The fleet consists of 115 five-car trains and 3 double-car trains. The average commercial speed of the metro system is 17.2 mph, with off-peak headways of 3 to 4 min and peak headways of 30 s. In 2004, this arrangement provided 343 million trips.

The bus fleet is made up of 1,003 vehicles. Of this total, 712 are single-decker buses with service regulated via global positioning system technology. All buses are air conditioned. There are 104 bus routes covering a total of 549 mi. Buses travel at an average speed of 7.6 mph.

In addition, TMB provides four transport modes used primarily by tourists: the Montjuic Funicular railway (providing access to the Olympic Ring and Montjuic Park), the Montjuic Cable Car, the Tramvia Blau (tram and trolley car service), and the Barcelona Bus Turistic.

In operation since 2004, Barcelona's two tram systems—Trambaix (western system) and Trambesòs (eastern system)—are operated by Tramvia Metropolita (TM), a private consortium. Together, they provide five rail lines, 18 mi of operating rail, and 55 stops and currently have 31 tram cars in service.

TMB and TM coordinate their efforts under the direction of the Entitat Metropolitana del Transport (EMT), now a component entity of the ATM. EMT was formed in 1987 to offer a combination of transportation services to area residents. EMT is responsible for a variety of transportation-related roles in the region including organizing, managing, planning, and coordinating public transportation services; administering taxi services; and providing road and rail programming and technical transportation assistance to municipalities.

Two agencies operate commuter rail in the Barcelona region: Renfe, Spain's national rail carrier, and Ferrocarrils de la Generalitat de Catalunya (FGC), the regional rail company. Commuter railroads in the Barcelona region have much closer station spacing than their U.S. counterparts. Renfe's commuter rail, which carries 114 million passengers per year, operates four rail lines on 161 mi of track with 104 stations. The smaller of the two providers, FGC, operates two commuter rail lines on approximately 54 mi of track serving 74 stations. It carries 76 million passengers per year.

Copenhagen, Denmark

Copenhagen is Denmark's capital and largest city. Located along the Oresund, the strait of water that separates Denmark from Sweden, the city is home to Denmark's national parliament, government, and monarchy. Copenhagen is also the country's primary business and financial center.

The city is divided into 15 administrative, statistical, and tax districts and is home to 502,000 residents. It covers an area of 55 mi^2. The greater Copenhagen metropolitan region, which also includes the municipalities of Frederiksberg and Gentofte, has a population of 1.1 million.

With a strong employment base, Copenhagen and the surrounding metropolitan area have experienced steady growth in recent years. The city's population has increased by 8% since 1992, and the metropolitan area's population is up by 3% since 2000.

The influx of new residents has increased the number of cars on the roads. Automobile ownership is at 313 vehicles per 1,000 citizens and climbing. However, Copenhageners still rely to a large extent on public transportation. Trains and buses account for 60% of the transport miles per year.

Copenhagen has a comprehensive, multi-modal transit system consisting of fixed-route buses, commu-

ter rail trains (called S-trains), and a heavy rail (metro) system. Operated by Hovedstadens Udviklingsråd (HUR), the city's transit authority, the overall transit system averages 5-min headways throughout the core of the city.

The bus fleet consists of 950 buses that operate on 270 routes. The buses provide 199 million boardings per year. The S-trains, which account for 119 million boardings per year, are the backbone of the system and reach most areas of metropolitan Copenhagen. The S-train network is also supplemented by regional trains that extend its reach to nearby cities such as Elsinore and Malmö, Sweden.

The metro is the most recent addition to Copenhagen's public transportation system. Copenhagen's metro opened in 2002 as part of a land development initiative. Serving passengers at 22 stations, the 13-mile system is fully automated with driverless train technology. Each train has a capacity of 300 people (100 seated, 200 standing). Service is provided on two lines that operate 24 hours a day, 7 days a week. Service frequencies on each line range from 4 to 6 min throughout the day. Late-night service is provided at 15-min intervals. The metro handled an estimated 40 million passengers in 2005.

Shanghai, China

Shanghai is China's economic, commercial, financial, and communications center. Located on the country's east coast, the city enjoys easy access to the East China Sea (part of the Pacific Ocean) via the Huangpu River delta. Shanghai's port, which processed 443 million tons of cargo in 2005, is expected to soon overtake Singapore as the world's busiest port facility. Almost one-quarter of all Chinese exports pass through Shanghai.

The city, which covers a total area of 289 mi^2, is bisected by the Huangpu River. The "original" city, or Puxi, lies on the western side of the river, while an entirely new financial district has been erected on the eastern bank of the Huangpu, in PuDong. Shanghai is one of four Chinese municipalities that have provincial-level status.

Economic growth in Shanghai in recent years has been impressive. The creation of the PuDong New Area, a special economic zone, in 1990 marked the beginning of the modern era of Shanghai's urban development. The city has undergone rapid economic expansion, experiencing gross domestic product (GDP) growth of 13.6% in 2004, following 13 consecutive years of similar double-digit increases. According to officials at the U.S. Consulate, Shanghai's GDP now totals $90 billion.

Population growth has gone hand in hand with the city's improving economic fortunes. The 2000 census estimated the population of Shanghai Municipality (which includes the city, eight surrounding districts, and the 30 islands in the Yangzi River) at 16.7 million, including a floating population of 3.9 million migrant workers—a 26% increase from 1990. Population figures vary greatly, however. Some sources indicate the total population in Shanghai Municipality is actually closer to 20 million.

Shanghai's population patterns are shifting too. The city is becoming more suburbanized; as many as 2.5 million residents left the central districts for suburban housing developments during the 1990s. As a result, by 2000, the total area of Shanghai's urbanized districts had increased to 1,515 mi^2, up from 136 mi^2 in 1988.

Public transportation's role is growing, but it is still relatively small for a city of Shanghai's size. Public transport accounted for 26% of all journeys in the city in 2003, up from 16% in 1998. In addition to walking, other major forms of mobility are bicycles, private cars, and taxis. There are 5 million bicycles, 900,000 private vehicles, and 43,000 taxis in use in Shanghai. Roadways are becoming increasingly congested. The 2004 Shanghai Metropolitan Transport Development Report estimates that 42% of roadways are congested in the Central Puxi area during peak travel hours (Figure 1).

Shanghai's public transportation system features buses as well as heavy and light rail. The system is run

Figure 1 Roadways in the Central Puxi area of Shanghai are congested during peak travel hours.

by a mix of public and private operators. Rail services are operated by two public enterprises, the Shanghai Metro Operation Corporation (SMOC) for heavy rail and the Shanghai Modern Rail Transit Corporation for light rail. Buses are operated by private and public companies, and service is planned by the Shanghai Urban Transportation Bureau (SUTB). Transit construction decisions are controlled by the Construction Committee for the Shanghai Municipal Government.

The Shanghai rail system, which opened its first line in April 1995, consists of four heavy rail lines totaling 54 mi in length and one 11-mi light rail line. Officials plan for this rail system to expand to 17 lines by 2010. It is expected to total 143 mi in length by 2007 and 255 mi by 2010, making it the fourth largest in the world.

Rolling stock on the four heavy rail lines consists of 546 cars built by suppliers that include Adtranz, Siemens, Bombardier, and Alstom. Siemens supplied 178 cars for the light rail line. Heavy rail trains normally operate in formations of six cars with a capacity for 1,860 passengers, but these can be increased to eight cars. Maximum allowable speed is 50 mph. Headways during rush hours range from 4.5 to 7 minutes on the four heavy rail lines to 11.5 minutes on the light rail line. The heavy- and light rail lines combine to support 1.7 million journeys per day.

The bus network, which carries 7 million passengers per day, consists of 18,000 buses operating on 942 routes covering 13,670 mi. The average commercial speed is 9.3 mph or less. Officials plan to increase average speed to 12.5 mph in the near future with the introduction of dedicated bus lanes.

Officials are also planning for the challenge created by the city's role as host of the 2010 World Expo. The World Expo is expected to be a showcase for Shanghai's emergence as an international economic powerhouse. Roughly 400,000 visitors per day (peaking at 600,000 to 800,000) are expected to visit the city during the event, which will tax the transportation system even further. Planners expect that 80% of visitors will arrive by public transportation—50% by heavy rail and 30% by bus. By that time, five heavy rail lines are expected to extend to the World Expo site, with each line having the capacity to move 60,000 passengers per hour.

Osaka, Japan

Located in the Kansai region of western Japan, Osaka is second only to Tokyo in terms of Japanese industry, commerce, and technology. The city, whose canals and crisscrossing waterways provided transportation for a booming merchant trade during much of the 20th century, is today also known for its modern architecture and varied nightlife.

As the region's economic center, Osaka has a resident population of 2.6 million and a workday population of 3.6 million. The Osaka metropolitan area has a population of 18.4 million. Unlike the three other cities visited by the study team, Osaka's population is declining. The city's population has declined by 17% since reaching its peak level in 1965. Osaka's residents inhabit a city that covers 138 mi^2 and has one of the highest population densities in the world. More than 70% of city residents live in areas with density greater than 14,500 persons/mi^2.

Osaka's merchant heritage has provided the city a solid footing in today's Japanese economy. Iron, steel, fabrics, ships, heavy and light machinery, and chemicals are all part of the area's economic output. The expansion of the city's harbor facilities in the early 1990s further bolstered Osaka's position as one of the country's major ports.

The city's public transportation network consists of buses, heavy rail (metro), light rail (trams), and commuter rail that are operated by both public- and private-sector entities. The Osaka Municipal Transportation Bureau (OMTB), a division of the city of Osaka, is responsible for the operation of the bus, metro, and tram systems. Commuter rail, which primarily serves the outer reaches of the Osaka metropolitan area, consists of 20 privately owned and operated lines. Six of these lines are operated by Japan Railways Group, which owns and operates 70% of the private railways in Japan.

Since the 1960s, the OMTB has devoted most of its energies to metro development as an effort to mitigate the effects of increased traffic congestion in the city. Metro systems in Japan have been a success because of their effective use of limited space, reduction of urban environmental problems (e.g., air pollution), and their positive impact on traffic congestion. Osaka's metro system consists of seven lines covering 73 mi with 112 stations. Peak headways range from slightly more than 2 min to 4 min for most of the system.

The metro system is augmented by a 4-mi tram line. The tram line serves the Nanko area, a predominantly commercial and international trade section of the city. Combined, Osaka's metro and tram components serve 2.35 million passengers per day, amounting to 30% of daily rail ridership.

OMTB operates three types of bus service: trunk line service (basic fixed routes), feeder service (routes to channel riders to metro service), and community

service (routes directed at transit-dependent and low-density areas). Overall, the city's buses provide sustaining service on 131 routes that cover 372 mi. Significantly, in spite of investments in improving the bus service, ridership has been declining since 1993. Average daily ridership is 250,000, according to the most recent data.

Commuter rail plays a key role in Osaka. The six Japan Railways lines (including the high-speed Shinkansen line) cover 298 mi in the metropolitan area. The remaining 14 private rail lines, owned and operated by five separate companies, cover a combined 459 mi and carry an average of 2.94 million riders per day.

Public transit ridership in Osaka, although still among the highest in the automotive world, is declining. Trips in private automobiles increased from 8% of total trips in 1965 to 39% in 2001. Transit ridership peaked in 1992, averaging more than 9.1 million passengers per day. Over the past 5 years, transit ridership has declined by about 20%. Still, Osaka's public transportation offerings account for more than 55% of the total transportation market share in the Osaka area.

PLANNING

Comprehensive planning is critical to ensuring the most effective use of valuable financial and operational resources. In the United States, planning is often guided by federal requirements, with which transit agencies must comply in order to receive federal funding assistance. In the organizations it visited, the study team encountered a wide range of planning strategies—from top-down approaches guided by long-term master plans created at the local level to more flexible, immediate arrangements that seek input from private-sector partners and customers—for delivering quality services and investing in public transportation infrastructures.

Barcelona

The ATM is responsible for infrastructure and service planning for all public transportation in Barcelona, regardless of the political administration or the operator running the service. The ATM's Pla Director d'Infraestructures (PDI), or Infrastructure Master Plan, 2001–2010 comprises all the activities in public transportation infrastructure in the metropolitan region for the 10-year period. The plan is guided by three main goals:

- *Network expansion* through increasing bus network coverage, developing a "family of services," and creating end-of-line connections on the metro system
- *Improvement of central exchanges* by building station connections in the core of the system
- *Modernization and improvement* to make the metro system more accessible and upgrade rail and bus rolling stock.

The current PDI includes the construction of the metro system's seventh line (called Line 9) and the expansion of the tram systems. It also includes funding for 31 interconnections among different metro lines. The interconnections are planned in the core of the system and at the ends of the metro lines, enabling more reverse commute trips. Interconnections in the center of the city will also improve connections among four metro lines and both commuter rail operators.

The plan also establishes a commitment to fund the maintenance and rehabilitation of existing transit facilities and fleets. For example, the PDI has committed to equipping all of the city's buses with wheelchair lifts by 2010, up from the current 80%. The plan also calls for modernization improvements to make 80 of the system's 123 metro stations accessible to persons with disabilities.

Unlike infrastructure, service planning for Barcelona's public transportation system is not guided by a comprehensive, multi-year plan. Rather, the service grantors (i.e., local political jurisdictions) request services. The ATM determines the levels of service and hours of operation provided on specific routes and services based on these requests. It then provides those plans to operating agencies or contractors for implementation. In the event that service is contracted, contractors will bid on a service contract based on the service levels dictated by the ATM.

Local political jurisdictions can also request new services or changes to existing services. If the cost recovery of a service request does not meet ATM standards, the requesting jurisdiction may subsidize the service. When the service meets cost recovery standards, the subsidy is removed.

Barcelona is also using new service planning philosophies to help the city meet the challenges of accommodating new transportation demand through the increased use of public transportation. Because ATM is responsible for all service planning, it is able to coordinate different services and facilitate transfers between modes and operators. This coordination allows the ATM to plan a "family of services"—services intended to target specific markets and

encourage multi-modal travel. For example, when the metro's Line 9 comes into service, the TMB will continue to operate some overlay service, but the majority of bus service will be restructured to provide access to Line 9. In addition, the EMT has established service guidelines and goals based on service spans and frequencies to ensure that its resources are being used as effectively as possible. If services do not meet these standards, service changes are considered.

The TMB's biennial contract with the ATM contains specific operational objectives that the metro and bus operators must meet. The two entities meet annually to examine program goals and compare them to actual results. The TMB has developed two measures—the Customer Satisfaction Index and the Objective Quality Index—to ensure that it is operating high-quality service, retaining existing customers, and attracting new ones. The Customer Satisfaction Index is measured quarterly and is based on surveys of customers' perception of service quality, outstanding needs, and prior projects or initiatives. The Objective Quality Index is based on goals set by the TMB that draw on the company's performance in operational areas, such as on-time performance, maintenance, and driver performance. This index is based on more than 2,000 hours of field surveys.

Copenhagen

Bus System

When the HUR decided in 2002 that it wanted to redevelop the city's bus system to improve service in downtown Copenhagen concurrent with the introduction of the metro, its planning approach was decidedly customer focused. The backbone of the effort was a comprehensive market study designed to determine what riders most wanted from their bus system. The research indicated that customers valued frequent service, schedule reliability, seat capacity on vehicles, enhanced waiting facilities, and increased speeds. Based on the market research, officials established a vision for a new bus network that would serve the downtown core. The resulting A-bus Network would be a simple, reliable, and comfortable "metro of the streets." HUR officials established the following service objectives for the A-bus Network:

- Easy to use
- High frequency
- Very simple timetables
- Buses stop at all stops
- Simple route numbering and structure

The planning effort produced six A-bus routes that now provide a grid network in downtown Copenhagen. The routes operate at 5-min frequencies from 4:30 a.m. to 1:00 a.m. In addition, the HUR developed more bus shelters and assigned new low-floor, three-door, and three-axle vehicles with climate control to the routes to improve ride quality and speed passenger boarding and alighting. Real-time customer information is also provided at stations, shelters, and stops, and next-stop information is provided on board the buses.

In addition to riders, the HUR engaged other key stakeholders in the planning for the A-bus Network. For example, in analyzing bus running times, the HUR realized that departures from bus stops, traffic signals, and queuing represent 40% of total in-service hours. To accelerate service, the HUR worked with municipalities and road authorities to develop joint action plans for bus priorities. The key to the success of these planning efforts was to develop plans for the entire route, rather than improving specific intersections. On Route 6A, for example, bus-only lanes, bulbout bus stops, queue jumpers, signal coordination, signal priority, and intersection redesigns resulted in a 5- to 7-min savings in travel time, a roughly 10% improvement. This plan, which cost 35 million kroner to implement, is expected to save 3 million kroner per year in operations.

Marketing and public information was also important in introducing the A-bus Network and capturing ridership. To distinguish the A-bus Network from other bus routes, HUR officials developed a distinct branding using the color red and incorporated it into buses with red-painted corners and red bus stop signs. To simplify use, route numbers and destinations were painted on the side of the buses.

The A-bus Network has successfully met its service objectives. Ridership on the six routes accounts for one-third of Copenhagen's total daily bus ridership. Travel time has improved through the implementation of bus priority measures, and the simple routing and high frequencies has increased the ease of use. Overall, more than 80% of riders indicate in surveys that they are satisfied or very satisfied with the service.

Metro System

The HUR's planning approach for the construction and operation of the metro system was significantly influenced by the city's 1947 "finger plan" for regional and transportation planning. This plan's bold outlines, which were reinforced by the city's long-range regional plan adopted in 1993, focus on urban growth and infrastructure development along five

major transportation corridors, or "fingers," radiating out of downtown Copenhagen. Employment is located near public transportation, while the areas between the corridors are preserved as open space.

In designing the metro, HUR officials identified several service objectives:

- Short travel time
- High reliability
- Fast, relevant, trustworthy information
- Friendly and efficient
- Safe
- Clean and comfortable
- Personable

After 2 years of operations, the metro has achieved its service objectives. Ridership has grown to 40 million in 2005, up from 20 million in 2003. (It is anticipated to reach 50 million by 2007.) Short travel times have been achieved through fast acceleration, dedicated right-of-way, and high frequencies. High reliability, with 98% on-time performance, has been aided by the metro's driverless train technology (Figure 2) and other automation. Fast, relevant, trustworthy information is provided at stations and on board trains. Service is friendly and efficient with employees posted at stations to direct riders and answer questions. Safety is enhanced through station lighting, staffed stations, call points, and closed-circuit television monitoring. Also new trains and stations provide a clean and comfortable waiting and traveling environment.

To ensure that service quality and operation efficiencies are maintained, the operating contract includes incentives and sanctions. The contractor is penalized for operation and maintenance problems or for not achieving the on-time performance target of 98%. Likewise, contractors are rewarded for increased ridership and customer satisfaction. Passenger satisfaction surveys are conducted every 6 months on passenger security, cleanliness of trains and stations, regularity and ride comfort, and the conduct and service of metro employees.

Figure 2 Copenhagen's 22-station, 13-mile metro system uses driverless train technology.

Shanghai

Given Shanghai's unparalleled growth and upcoming role as host of the 2010 World Expo, the city's public transportation planning imperative is simple: provide as much capacity as quickly as possible. City transportation officials readily admit that Shanghai is well behind other international cities in its transport development and has much catching up to do. They also have a strong desire to develop, at least in theory, an environmentally friendly city and public transportation system.

The normal metrics and concepts of transport planning are generally not applicable to Shanghai because of its unparalleled growth (Figure 3). While most world cities are concerned with sustainable growth and limits to further decentralization, Shanghai is encouraging numerous satellite cities and rapid suburbanization. The market for the transit system being built is intertwined with the city's expansion and land that is being developed along railway lines. However, the market segmentation of transit versus auto users is not well defined in relation to the mix of residential, commercial, and business centers that compose the long-term city development plan. Despite these factors, quickly reaching the capacity of the transit sys-

Figure 3 A room-sized model at Shanghai's Urban Planning Exhibition Hall depicts all current and planned structures for the city.

tem is not likely to be an issue, given the acute need for mobility now and in the future.

Shanghai's 2020 Master Plan, which grew out of a symposium of international planning experts, is the basis for the city's current and long-term transport planning. This plan envisions a comprehensive rail system of 500 mi, consisting of 11 heavy rail lines supplemented by 6 light rail lines (up from the 4 heavy rail lines and 1 light rail line currently in operation). The SMOC plans to establish separate corporations to build and operate each of the heavy rail lines, with the shareholders consisting of SMOC and the local governments in which the lines operate. According to SMOC officials, these management teams have already been established.

While the rail system is the backbone of future plans for expanding Shanghai's transit, city buses currently move five times as many passengers as the rail system. The SUTB performs the service planning for the buses and dictates the quality of service that is to be provided. Specific standards are included in the contracts with private-sector bus operators for a range of parameters, including service frequency, equipment, technology, and architecture.

Officials are aware of the bus system's important role in helping the region to meet its long-term mobility needs. Arterial road capacity is expected to triple between 2000 and 2020, in part to support an anticipated growth in "park and ride" centers to connect the hubs to central Shanghai. The SUTB is completing a strategic plan to guide the delivery of bus service over the next 5 years. While SUTB officials have not indicated that they will increase the massive bus system, they are planning to replace almost one-half of the fleet with "clean energy" vehicles. They also foresee a growth in the network of rapid transit bus lanes, particularly in the downtown area.

The 2020 Master Plan provides a broad framework for future development, but it appears local Shanghai officials have wide discretion as to how the details are implemented. While all plans are subject to approval by the central Chinese government, Shanghai municipal officials have wide powers in establishing the direction of future development and construction plans. The municipal government acts as a city-state in its exercise of annexation and eminent domain, unfettered by regulatory constraints common in the United States and other western countries.

City transportation officials have established guideposts regarding future transit growth to measure the success of their planning efforts. For example, by 2020, the number of rail transit trips is expected to grow to 12 million per day, more than the world's current transit leader, the Moscow metro (approximately 10 to 11 million daily riders). The number of daily bus trips is expected to grow to 9 million. Transit trips in total are expected to increase to 35% of all trips in 2020, up from 21% in 2000. These benchmarks are important, but officials note that the success of their transit planning is just as likely to be judged in terms of its contribution to GDP growth and levels of foreign investment.

Osaka

Publicly Owned Transit

In Osaka, a number of factors—including a greater reliance on private auto transport, a declining birth rate, an aging population, and an increase in the number of workers who telecommute—have negatively affected the publicly controlled transit services in recent years. As mentioned earlier, public transit ridership in Osaka, which peaked in 1992, has declined by 20% in the past 5 years.

The OMTB is focusing on plans to stem the decline in ridership and improve the financial situation of the metro, bus, and tram lines. Over the past 3 years, the bureau has been implementing a 5-year Management Reform Plan (fiscal years 2002–2006) that contains business philosophies and specific initiatives targeted to retaining and recovering ridership through three means:

- Improving service quality
- Increasing accessibility for the elderly and persons with disabilities
- Increasing revenue

Service Quality Improvements. The OMTB has initiated several upgrades and system amenities to improve service quality. On the metro system, in various stages of implementation, are signage upgrades to improve system way-finding information, the addition of English language displays and way-finding information, light-emitting diode destination and train location boards, and air conditioning in the stations. Metro cars are also being remodeled and reconfigured to accommodate passengers with physical disabilities. To facilitate integrated and seamless passenger transitions from the metro to bus lines, information boards with bus schedule information have been installed adjacent to ticket gates at several metro stations.

Modifications to the bus system include the construction of bus shelters with bus location indicators, illuminated timetables and information boards at bus

stops, guide chimes and Braille information plates for the visually impaired, voice notification of bus approach and location indicators installed at bus stops and public facilities, and construction of bus-stop plazas (hubs) to provide comfortable waiting environments. To achieve greater service reliability and on-time performance, the OMTB has introduced peak-hour bus priority traffic signals and priority lanes. The bus fleet has also been upgraded for passenger convenience; all vehicles have air conditioning, low floors, wider doors, wheelchair lifts, and fare boxes that accept prepaid cards.

Access for the Elderly and Persons with Disabilities. In response to Japan's aging population and to comply with the Barrier-Free Program Transportation Law (similar to the Americans With Disabilities Act in the United States), the OMTB is implementing steps contained in the plan to improve access for elderly passengers and passengers with physical disabilities. Elevators and escalators are being installed at all metro stations to enable passengers with mobility issues to move between underground platforms and the street level without using stairs. Flexible between-the-rail-car barriers are being introduced to protect sight impaired passengers. More metro stations are adopting wider ticket gates to provide better wheelchair access.

Other enhancements include continuous handrails, tactile panels, audio guiding devices, Braille fare lists, Braille identification plates and space for wheelchairs on metro cars, wheelchair-accessible toilets, folding entrance door ramps, and public information fax machines for the hearing impaired.

Strategies for Increasing Revenue. The introduction of a specialized bus service and more convenient fare options are two of the more noteworthy strategies the OMTB is pursuing to increase transit revenue, as prescribed by the Management Reform Plan.

To attract more riders from transit-dependent, low-density areas, the OMTB has introduced a new community bus service, the Red Bus line. Red Bus uses smaller (seating capacity of 22 to 27 passengers), non-step vehicles on 21 routes in 18 of Osaka's 24 city wards. Among the service's benefits are connections to facilities essential for daily activities, short-distance transportation, and increased operating frequency to transit-dependent areas during off-peak hours.

The OMTB is also working to encourage transit use, and increase revenue, by providing passengers more convenient fare options. The transit system's Rainbow Card, which automatically deducts fares from a prepaid card as the customer passes through a ticket gate or by a fare box, was introduced in 1996. The card is part of the Surutto Kansai system, a prepaid fare system covering municipal and private railways in the Kansai region using a single card.

Other more recent fare initiatives include the Multiple Ride Card and the No-My-Car-Day Pass. The Multiple Ride Card offers discounted fares and can be used on any metro line, new tram line, or bus line. The No-My-Car-Day Pass (Figure 4) is a special day-pass program to encourage passengers to ride public transit. This pass—which provides an unlimited number of metro, tram, and bus trips on a single day for a flat fee—can be used on official No-My-Car days (every Friday and the 20th of each month) in Osaka.

The most innovative fare option yet is the planned spring 2006 launch of the IC card, a card with one or more integrated circuits that allow for seamless travel and fare integration as well as increased commerce. For example, the Postpay IC for Touch and Pay (PiTaPa) provides cardholders a benefit program that encourages them to use the card for transit trips and for shopping at PiTaPa-affiliate shops.

Surutto Kansai officials predict the IC cards will increase use of public transportation, help maintain the fare-box ratio, enable shops to expand their customer base without having to invest in additional parking

Figure 4 Osaka's No-My-Car-Day Pass encourages ridership by allowing unlimited rail, tram, and bus trips on a single day for a flat fee.

spaces, and reduce the number of cars and the amount of carbon monoxide emissions. When the program was recently tested in Japan's Hokkaido prefecture, ridership increased by 20%.

Privately Owned Commuter Rail

In contrast to publicly operated transit, the planning focus of privately operated commuter rail (Figure 5) in the Osaka region is centered on real estate development and increasing the population in low-density areas served by the rail lines to cultivate a stable and reliable customer base.

Unlike publicly operated transit lines that follow population growth, private rail lines in Japan have historically been built in low-density areas outside the reach of the government-sponsored transit services. As a matter of economic survival, the private companies must increase the population along the rail lines in order to remain profitable.

Private operators responsible for the lines that serve the Osaka metropolitan region today are particularly active in real estate development, viewing themselves as lifestyle developers in addition to being transportation providers. Through the creation of housing and other vital services around their lines, they are creating environments with built-in ridership.

Planning activities are focused on how to create mixed residential and commercial developments that will attract potential residents. The rail companies are facilitating the construction of recreation facilities, department stores, theaters, restaurants, hotels, sports facilities, and other attractive amenities to aid this goal.

With rail operators becoming more diversified in their business activities as a result of the focus on real estate development, some are taking part in multi-company groups that allow independent businesses with complementary development plans to band together. Group members may be linked financially through cross-shareholding or other interlocking arrangements. It is not uncommon for the groups to provide a full range of lifestyle services to the population surrounding the private rail line. However, Japan's Railway Accounting Ordinance makes it unlawful for group members to cross-subsidize between rail and non-rail businesses.

Figure 5 A commuter rail train pulls into the station in Osaka.

FINANCING

The mission team encountered a range of financing approaches in the European and Asian cities it visited. Private funding; top-down, public sector funding; and using proceeds from land sales are just a few examples of the financing strategies that many public/private transit partnerships are pursuing. These arrangements have generated significant outcomes that include easy access to needed capital funding, redesigned fare systems for better fare box recovery and increased intermodality, and transit systems that are serving as catalysts for smart land use and development practices.

Barcelona

Capital Funding

Capital funding for TMB is provided completely through subsidies, with the federal government providing 20% and the local municipalities providing 80%. The arrangement is the opposite of federal and local assistance percentages for most capital projects in the United States.

TM—the private consortium formed to design, build, finance, operate, and transfer ownership of the tram system—operates as a contractor for the ATM. The TM consortium consists of 11 private shareholders. Five of these shareholders are involved in the system's construction, four in its operation, and two in its financing.

The capital cost for the design, planning, and construction of the tram system was approximately 548 million euros. All capital financing for the two tram projects—Trambaix and Trambesòs—came from private sources. The TM consortium provided 12% of the capital, and bank financing provided the remaining 88%. Project risks were shared by the private consortium members and governmental entities according to risk category. By entering into an agreement with

TM, the local and regional governments were able to limit the amount of risk they assumed.

The TM/ATM contract calls for TM to operate the tram system for 25 years. At the end of the contract period, ownership of the system will return to the ATM. The project's bank financing is amortized over the contract's life and is guaranteed by the TM consortium shareholders. Because this was the first tram project of its kind in Spain, Spanish banks were reluctant to invest. As a result, European banks more familiar with this kind of project provided the capital financing.

At the beginning of each fiscal year, TM is paid an operating fee based on projected tram ridership. This fee is adjusted at year-end to match actual operating results. Any projection shortages or overages are shared equally by TM and ATM. This private outsourcing arrangement allows the central and local governments to build and operate the tram system on a pay-as-you-go basis. All capital assets and debts will be maintained on the TM consortium financial statements until they are transferred to ATM at the end of the contract term.

Operations Funding

Tax Revenues. Tax revenues that support public transportation services in the Barcelona region come from real estate taxes on individuals and businesses, and street and underground parking fees. Spain currently has no national fuel tax.

Spanish federal government revenues are distributed to metropolitan transportation systems based on system size and cost demands; these revenues make up 45% of a system's total subsidy. The remaining subsidy portion comes from the regional government (11%) and the municipalities served by the system (44%). Any operating deficits are the responsibility of the local municipalities. Barcelona operates in a "donor state" environment: the federal revenues received for transportation operations and infrastructure are currently less than the amount of federal taxes the region pays to Spain's national government.

Fare Revenues. Ridership plays a major role in supporting the operating costs of Barcelona's public transportation system. Overall, TMB supports 50% of its total annual operating costs through customer fares. The balance of the operating budget comes from other income such as advertising and rents (6%) and government subsidies (44%). The metro system derives 70% of its operating revenue from customer fares; 35% of the bus system's operating revenue is fare based.

Barcelona is taking steps to maximize fare-based revenues by implementing an integrated fare system across all public transportation modes.

Previously, there were 41 operators with four price modes: flat rates, kilometric rate for buses, kilometric rate for the metro lines, and a system of zones for commuter rail. The fare criteria were not homogeneous when the modes were compared on the same basis.

The creation of the ATM gave officials an opportunity to develop a new integrated fare system. The system, implemented in 2001, extended the metropolitan region to the Renfe and FGC local train networks, covering 202 municipalities and serving 4.5 million inhabitants. It divided fare zoning into six crowns, or rings, and 33 different sectors. The crowns have a concentric shape around Zone 1 and are defined according to the distance. A fare zone consists of the intersection between crowns and sectors. There are eight radial sectors based on the preferential mobility corridors of the RMB. The ATM ticket (Figure 6) allows the user to choose between eight different fare options (e.g., 10 days, 50 trips in 30 days, unlimited trips per month). The prices are fixed according to the number of zones crossed on each journey with a maximum of six zones. The public operators are compensated monthly according to their contracts, and the private operators are compensated based on their concession contracts.

The new fare system has been a substantial improvement. It is helping to position public transpor-

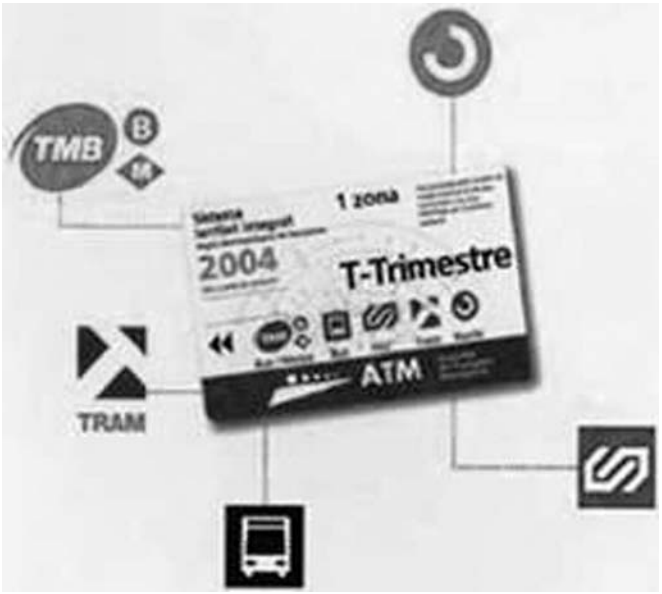

Figure 6 Barcelona transit riders can now use one ticket on rail, bus, and tram modes.

tation as an attractive alternative for users, with an easy-to-understand fare system based on an integrated and unified network. At the same time, the system is helping to improve cost recovery by increasing intermodality (i.e., transfers between modes). In addition, the system has enabled the ATM to automate the follow-up process for earnings distribution that also determines the intermodality index. The intermodality index of Barcelona's overall public transportation system has now increased to 21%, up from 8% before the new fare system went into effect. More than 30% of the journeys transfer between modes.

Copenhagen

The HUR, the transit authority in Copenhagen, receives 30% of its revenue from the counties it serves. The remaining 70% comes from the HUR's budget and from customer fares. Transit fares in Copenhagen increased by roughly 12% in 2004.

The HUR has turned over operation and maintenance of the bus system to the private sector to reduce costs and maintain long-term efficiency. Today, all bus lines in Copenhagen are contracted out to private companies. In 1990, only 18% of the bus service was run by the private sector.

Bus contracts with private operators are for 6 years with a 2-year option. Each contract specifies the number of revenue hours per route; requirements for bus design, driver service and knowledge, existing labor agreements, emissions standards, reemployment of drivers and technical staff; and customer satisfaction goals. Each contract also includes incentives and sanctions partly based on customer satisfaction. Each operator is required to conduct 25,000 annual surveys on punctuality, driving and driver behavior, inside cleanliness, outside cleanliness, noise, temperature, and ventilation. The results of these surveys form the basis for bonuses and penalties and ensure that quality of service is maintained at a high level.

The average cost of bus service is approximately 450 kroner per hour and includes operating and capital costs. The HUR believes it is saving an average of 20% per hour from the transition to private operators. The private companies are more efficient, can buy buses at a lower cost, and are able to use leasing systems to finance the equipment. In addition, the companies have successfully reduced the number of sick days taken by employees. Before the bus service was contracted out, employees took an average of 25 sick days annually. Employees are now averaging 5 to 7 sick days per year.

Metro System and Orestad

Copenhagen's metro system is being built using a financing strategy that includes donated land and government-backed loans. In 1993, city officials created the Orestad Development Corporation, a public corporation that now owns the metro. The corporation was established to develop a new neighborhood in Copenhagen; to build an efficient, rail-bound new transportation system for the city and the new neighborhood; and to secure the new transportation system as a partner in Copenhagen's overall public transportation system.

The principal financing mechanism for the metro was the donation of 750 acres of undeveloped land to the corporation. The corporation is using the land to create Orestad, a new town that will feature an attractive mix of residential, public, and commercial development and will be served by the metro (Figure 7). Using the land as collateral, the corporation secured roughly 13 billion kroner in government-backed loans for the metro's construction. The metro loans are being repaid by the proceeds from the new town's real estate taxes and sales and the metro's operating profits.

The total project cost is estimated at 13 billion kroner. Project income over 30 years is also expected to be 13 billion kroner and will come from real estate sales (51%), metro operating revenue (30%), government (10%), and taxes (9%).

Prices for residential and commercial sites, which are set by the corporation and are based on market trends, were 2,800 kroner/m^2 at the end of 2004. By March 2005, the corporation had raised site prices to 3,100 kroner/m^2.

Figure 7 Copenhagen metro train passes through the new town of Orestad, part of the region's innovative financing strategy for the metro.

By the end of 2004, 60% of the sites had been purchased by private buyers. Site usage is designated 29% for commercial use (offices), 44% for other purposes including retail and public institutions, and 27% for residential. The residential component consists of private family housing (57%) and student housing and subsidized family housing (43%).

Financially, the project is currently ahead of its projections because of a higher-than-expected return on real estate sales. Operating expenses, however, are slightly higher than expected and the operating revenues are coming in slightly under projections primarily because of lower-than-expected ridership. At the end of 2004, the metro system had a before-depreciation profit of 15 million kroner and the corporation had a before-depreciation profit of 10 million kroner. At the end of 2004, the corporation's debt was 15 million kroner with an effective interest rate of 4.3%.

Although construction of the metro took 2 years longer than originally expected, the first phase of the system is now complete and viewed largely as a success. Officials are now planning to extend the metro system. Danish government and city officials have agreed to build a new 9-mile circle line, the City Ring. This underground extension will use the same basic operational and design elements as the current metro. While the legislative process is ongoing, if all goes as planned, the new line should be completed by 2016.

Fixed Link Bridge and Citytunnel

Copenhagen officials are also involved in two other important transportation projects—the Fixed Link Bridge and the Citytunnel—designed to support the continued development of cross-cultural exchange between Denmark and its close neighbor, Sweden.

The Fixed Link Bridge between Copenhagen and Malmö (Sweden's third largest city) was completed in 2000. The 10-mile link consists of a tunnel from Denmark to a man-made island in the Oresund Sound and a cable-stayed bridge from the island to Sweden. It includes a motorway that carries more than 12,000 vehicles per day and a railway that serves more than 17,000 passengers per day.

A private company, Oresund Bridge Consortium, was created and is owned by the two governments. This company received state government-guaranteed loans to build the bridge. The loans are to be paid back over 30 years. Tolls are collected on the bridge to pay for current year operations and to repay the loans. Currently, the toll revenue is not meeting expectations. If this trend continues, it will likely take twice as long to pay back the loans. The current round trip cost for a toll is 500 kroner. Discounts are offered as more trips are taken. The total cost of the bridge was 30 billion kroner.

When completed in 2011, the Citytunnel will enhance railway speeds and efficiencies from Copenhagen to Malmö. The Citytunnel project will connect the Fixed Link Bridge with Malmö's Central Station directly through the center of Malmö. The project, consisting of 10.5 mi of electrified railway through Malmö, includes a 6.8-mi double-tracked section under the city, a 3.7-mi single-track section to the east, and two new underground stations. The Citytunnel is expected to increase rail travel to Copenhagen by 40%.

Shanghai

Shanghai's ambitious goals for expanding the city's public transportation system—particularly the rail system—will require an extraordinary level of financial support. While a significant amount of government funding will be involved, transit officials indicated that they also plan to rely on private-sector investment. The 2020 Master Plan, developed in 2000, calls for a 17-line rail system to be in place by 2010. At the end of 2005, five lines were in operation. With the completion of the new lines, Shanghai's rail system is projected to accommodate 40% of total urban movements (compared to the 11% today).

The rail expansion project will cost an estimated 200 billion renminbi. While the city's early rail system development was financed solely by the government, Shanghai public transit officials have recently turned to the private sector to provide operating and capital funds. In 2002, the rail system was opened up to private investment through the issuance of bonds. To finance this upcoming expansion, transit officials are issuing complete design, build, operations, and maintenance contracts for individual lines. Under these agreements, the private sector is responsible for complete design, construction, and operation of the lines. The contracts also include confirming arrangements for operations and maintenance facilities.

Management teams have been formed to oversee the design, construction, and operation of each line and ensure delivery of a high-quality service. The teams include representatives from Shanghai Metro Transit Corporation (SMTC) and local governments. To assemble the necessary expertise involved in overseeing the large number of private-sector contracts, the SMTC has been recruiting professionals from other transit systems in China.

The local government districts along the lines have input into the design and operation of the service

through their participation on the management teams. Specific parameters under the local purview include architectural treatments, materials, and colors.

The SMTC is coordinating the overall program and is responsible for overseeing assets, operations, and financial returns. International competitions are being held to attract interest from a wide range of firms.

Property acquisition is a key issue. A government agency is responsible for acquiring property and relocating residents. Affected residents are compensated with cash payments or relocated to apartment buildings in the greater Shanghai area.

Representatives indicated that newly built lines take 10 years to generate sufficient ridership to pay for operating costs. (Line 1, which carries the majority of metro passengers, just recently attained maturity after 10 years of operations; passenger fares now cover all of the operations and maintenance costs.) In the interim, government subsidies will be required. To help cover the cost of these subsidies, government officials are considering new financing sources including real estate development projects and fees from developers.

Shanghai's bus service has a few more years of experience with private-sector financing and operations than the rail system. In 1995, the SUTB, the agency planning and overseeing the city's buses and taxis, opened the bus system to private-sector investment and operation. Bus service had previously been provided solely by the government.

SUTB representatives indicated that they sought private involvement in order to expand and enhance the bus service available to the public. Today, 44 private firms operate the buses for the city's 942 routes. However, five companies provide 80% of the service, while smaller companies provide service in the suburbs. Since the transition to private operations, service coverage in the suburbs has been greatly expanded and route adjustments in the downtown area have helped to streamline routes and maximize efficiency.

Competition for bus routes among private-sector bidders is intense, according to transit officials. When new routes are auctioned, participants include local and international firms. The service period of the contracts varies between 1 to 8 years.

The private operators provide the buses, depots, and support facilities. In some cases, buses are provided by SUTB through lease arrangements. Operators retain the fare revenues and any revenues obtained from private advertising. The government does not subsidize operators' costs. Operators are solely responsible for the service and all costs, but transit officials have indicated that the government may need to consider providing subsidies if fuel prices increase.

Companies are encouraged to offer the best service possible and to make capital investments (e.g., buying new buses) as needed. Operators are required to conduct regular surveys of passengers for input on service issues. SUTB agents also perform service inspections. A telephone hotline is available for passengers to report any specific concerns or issues they may have about the bus service. Shanghai transit officials indicated that considerable work remains to be done to improve the overall efficiency of bus operations and to improve the transit experience for bus riders.

Osaka

The construction of the OMTB's core metro network was planned and subsidized by the government. The Subway Construction Cost Subsidization Program, instituted in 1962, offered 70% government subsidization of construction costs for publicly operated metro lines. Because of subsequent legal modifications, the government subsidy now totals 73% of metro construction—consisting of 20% from the municipal general account, 25% from the national government, and 28% from the local government.

In addition to basic construction subsidies for the metro lines, the Infrastructure Construction Subsidization Program offers a 60% government subsidy for infrastructure related to the construction of public and semi-public monorail and tram systems. Government subsidies are also provided to the OMTB for station improvements, fire prevention measures, and other matters of public safety, health, and welfare.

With the exception of small government subsidies provided for community bus service, which is deemed essential because it provides mobility options to transit-dependent and low-density areas, the OMTB-operated transit services do not receive any operating subsidies. Rather, the system is self-supporting and enjoys healthy operating-cost recovery from fare revenues. Smart card technology has been introduced in both the rail and bus systems for fare collection. Smart cards are being used not only to increase revenue, but also to generate ridership by introducing convenience that will make transit a more attractive option. Full integration of these modes, as well as taxi, ferry, and parking, are planned but remain a longer-term objective.

Except for the Japan Railways lines, which were originally built by the Japanese government and sold to Japan Railways Group in 1987, commuter rail lines in the Osaka region were constructed without

government subsidies. Low-interest loans are available to the private rail companies from government banks but, for the most part, the companies are completely self-reliant for everything from capital construction to ongoing operations. Their ongoing profitable operation is attributed to population densities in the major Japanese cities, efficient management, business diversification, and strategic development.

APPENDIX A—STUDY MISSION TEAM MEMBERS[1]

Richard Simonetta (Team Leader), Chief Executive Officer, Valley Metro Rail, Phoenix, Arizona
Ildefonso Burgos-Gil, Director, Design Area, Puerto Rico Highway & Transportation Authority, San Juan, Puerto Rico
William Cartwright, General Manager/CEO, Metropolitan Tulsa Transit Authority, Tulsa, Oklahoma
Conan Cheung, Director of Planning & Performance Monitoring, Metropolitan Transit System, San Diego, California
Carolyn Flowers, Executive Officer, Operations Administration, Los Angeles County Metropolitan Transportation Authority, Los Angeles, California
Cynthia Hernandez, Chief Financial Officer, Capital Metropolitan Transportation Authority, Austin, Texas
Keith Hom, Chief, Operations Planning, MTA New York City Transit, New York, New York
Lottie Jones, Deputy Executive Director, Santee Wateree Regional Transportation Authority, Sumter, South Carolina
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Teresa Sedmak, Manager of Debt and Investments, Regional Transportation District, Denver, Colorado
Mary Shavalier, Director of Planning, Hillsborough Area Regional Transit, Tampa, Florida
Janet Abrams, Mission Coordinator, Vice President and COO, Eno Transportation Foundation, Washington, DC

APPENDIX B—STUDY MISSION HOST AGENCIES/COMPANIES

Barcelona, Spain

Trambaix UTE–Trambesòs UTE
Transports Metropolitans de Barcelona
Barcelona Regional Transport Authority
Cataluña Regional Government
Entitat Metropolitana del Transport
Tramways Concessionnaire, Tramvia Metropolita, S.A.
FCC Connex

Copenhagen, Denmark (including Malmö, Sweden)

Orestad Development Corporation
Hovedstadens Udviklingsråd
Øresundsbro Konsortiet (in Malmö, Sweden)

Shanghai, People's Republic of China

Shanghai Urban Transport Bureau
Construction Committee for the Shanghai Municipal Government
Shanghai World Expo 2010 Coordinating Bureau
Shanghai Shentong Holdings, Ltd.
Shanghai Metro Operation Company
Transrapid International
U.S. Consulate General, Shanghai
PB Shanghai

Osaka, Japan

Osaka Municipal Transportation Bureau
Toshi Kotsu Kenkyusho
Kinkisharyo Corporation
Surutto Kansai Corporation

APPENDIX C—LIST OF ABBREVIATIONS

APTA	American Public Transportation Association
ATM	Autoritat del Transport Metropolità
EMT	Entitat Metropolitana del Transport
FGC	Ferrocarrils de la Generalitat de Catalunya
FTA	Federal Transit Administration
GDP	Gross Domestic Product
HUR	Hovedstadens Udviklingsråd
ITSP	International Transit Studies Program
OMTB	Osaka Municipal Transportation Bureau
PDI	Pla Director d'Infraestructures
PiTaPa	Postpay IC for Touch and Pay
RMB	Region Metropolitana de Barcelona
SMOC	Shanghai Metro Operation Corporation
SMTC	Shanghai Metro Transit Corporation
SUTB	Shanghai Urban Transportation Bureau
TCRP	Transit Cooperative Research Program
TM	Tramvia Metropolita
TMB	Transports Metropolitans de Barcelona
TRB	Transportation Research Board

[1]Titles and affiliations are at the time of the mission.

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